Phasing Out Mercury Pollution in Michigan

BACKGROUND OF THE MICHIGAN MERCURY PHASEOUT PROJECT

- **Portions of each Great Lake are under fish consumption advisories for mercury**
- **Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin each have statewide advisories for mercury**

Each waterway under an advisory is classified as impaired.

Background (Con.)

- Each state is required through the Clean Water Act's Total Maximum Daily Loads (TMDLs) to clean up all of these waterways

- Cookie-cutter TMDLs for mercury are time-consuming, expensive, and technically challenging

- NWF and EPA each has proposed a new approach to mercury TMDLs: any state that phases out mercury within its borders satisfies its TMDL requirements

Background (Con.)

- NWF has proposed that Michigan pursue a mercury phaseout to satisfy its TMDL requirements
- We have developed phaseout scenarios and costs as part of the proposal
- Except as explicitly stated, the scenarios, costs and analysis presented here are NWF's data, and not the state's
- All data and analysis are draft and preliminary

Mercury: *Harm to People and Wildlife*

•Potent neurotoxin that can cause damage to the brain, central nervous system, lungs

•Common exposure: fish contaminated with mercury

• CDC: 1 in 10 U.S. women of childbearing years have Hg levels that exceed U.S. EPA's reference dose

•Effects on wildlife include growth inhibition, reproductive impairment

MICHIGAN

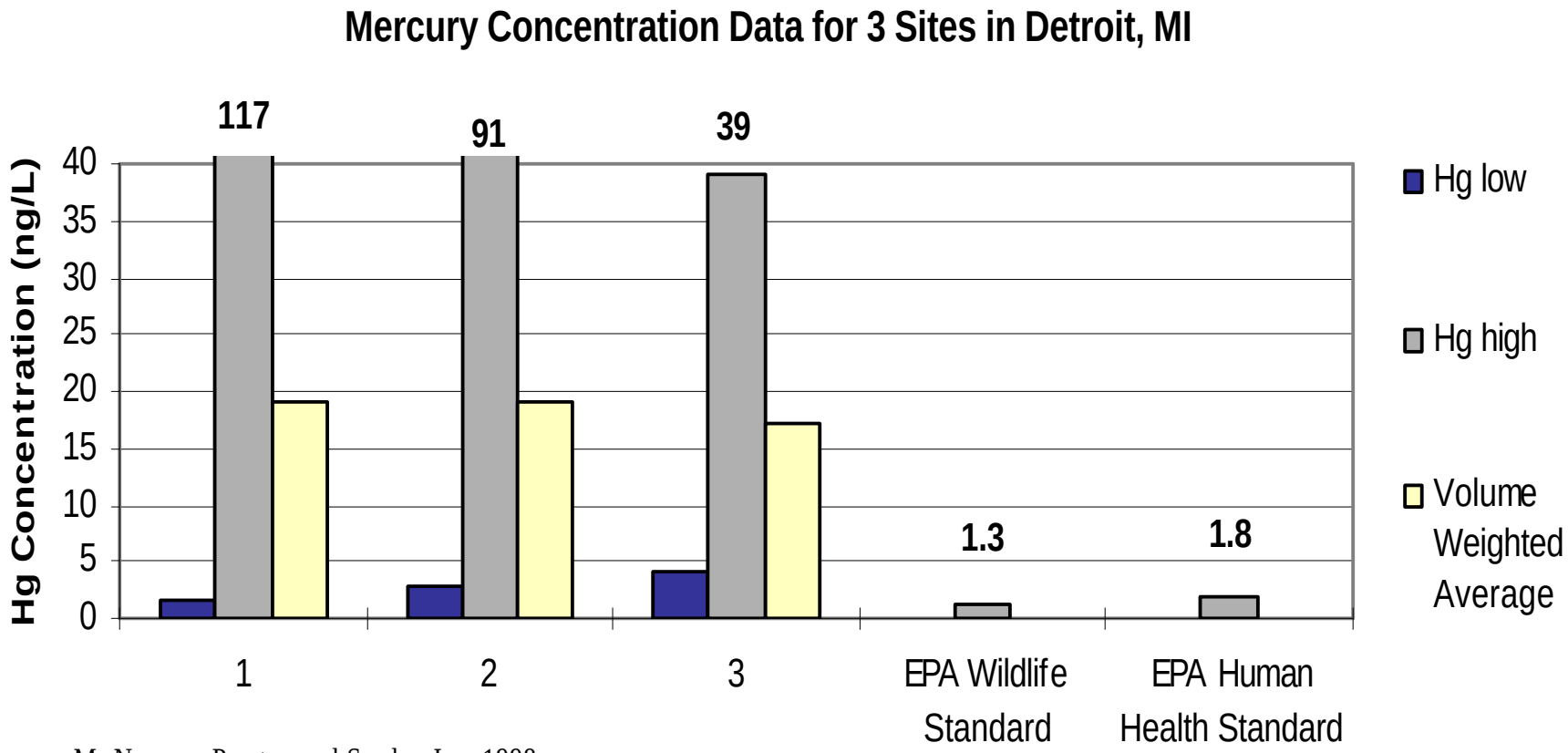
2001 FISH ADVISORY

IMPORTANT FACTS TO KNOW IF YOU EAT MICHIGAN FISH.

Advisory on Mercury in Michigan Inland Lakes

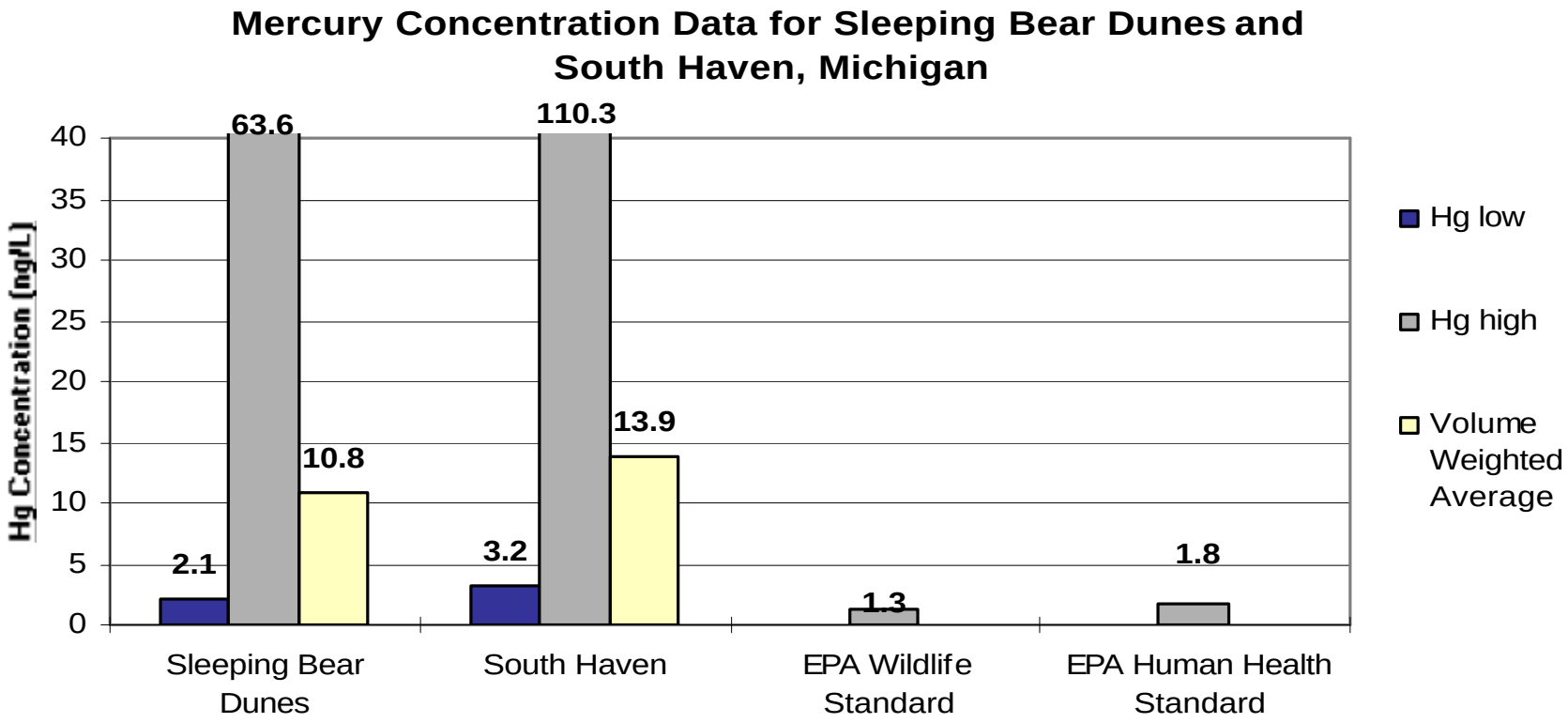
- **No one should eat more than one meal a week of rock bass, perch, or crappie over 9 in. and any largemouth bass, smallmouth bass, walleye, northern pike, or muskie from any of Michigan's inland lakes**
- **No more than one meal per month of the above fish should be eaten by women of childbearing age or children under 15**

Mercury Concentration in Rain: Detroit



Source: McNamee, Porter and Seeley, Inc, 1998.
"Atmospheric Deposition Study of PCBs, Mercury and Cadmium."

Mercury Found in Rain in Sleeping Bear Dunes and South Haven, MI



Source: Landis, M. - Ph.D Thesis University of Michigan , 1998.

The Mercury TMDL Requirement

- Michigan must prepare mercury TMDLs for every one of its inland lakes and portions of the Great Lakes, a potentially overwhelming task.
- The TMDLs must address all sources of mercury: waterborne, airborne, and sediments. Some sources are located outside the state.
- Under the normal TMDL process, extensive and expensive modeling and monitoring are required to address airborne mercury, the largest source.

The state mercury phaseout strategy: EPA certifies that a state has completed all legal requirements for a mercury TMDL if the state:

- adopts an appropriate phaseout plan,
- demonstrates that the targets will be achieved, and
- implements the plan to achieve the targets.

Elements of NWF's phaseout plan

- **One: Cut Hg air emissions 90% by 2010; "virtual elimination" by 2020.**
- **Two: Water dischargers meet appropriate water quality standards.**
- **Three: 90% of mercury hot spots cleaned by 2010 and all by 2020.**

Element One:

Mercury Air Emissions Reductions

Reduction Targets

•90% reduction from 1996 baseline by 2010

• Virtual Elimination by 2020

Reductions from major sources

- **Coal-Fired Power Plants**
- **Incinerators**
- **Steel**
- **Industrial and commercial boilers**
- **Others**

Element Two:
Reducing waterborne mercury discharges

Reduction Targets:

- meet actual water quality based effluent limitations for Hg within 5 years
- Exception for municipal wastewater treatment plants: meet variance limit, plus phase out Hg sources to sewers.

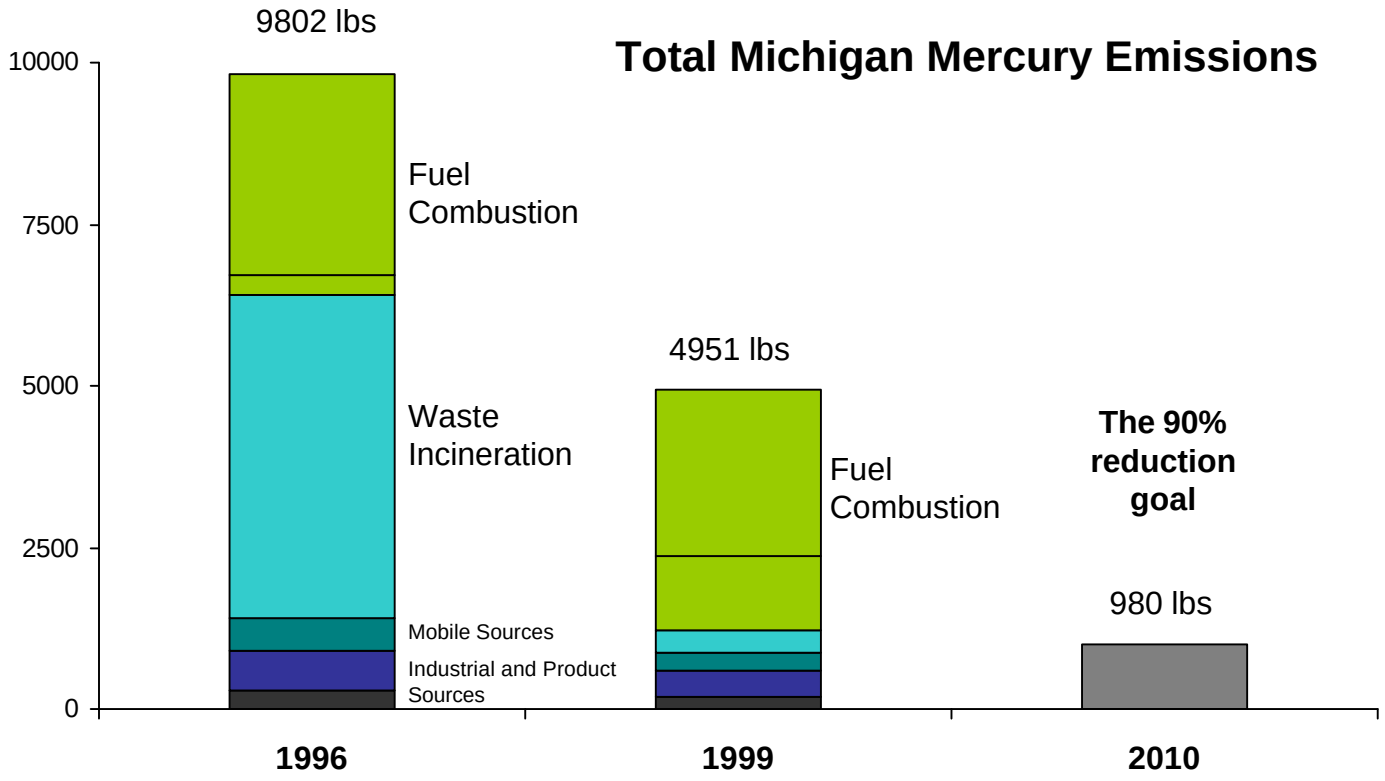
Element Three: Clean Up Mercury Hotspots

Reduction Target:

- **clean up 90% of the mercury hotspots by 2010 and the remaining ones by 2020**
- Mercury hotspot: an area of sediment (or soil) that has significantly higher concentrations of mercury than the background in the area and is a significant source of contamination to waterways.
- This strategy doesn't address the question of "how clean is clean."

- Focus on emissions
- MI Hg emissions inventory and targets
- Sector by sector analysis
- Summary

Substantial progress has been made since 1996 in cutting State mercury emissions



In only 4 years 50% of the reductions have been accomplished. However, some of the more difficult to address areas remain….

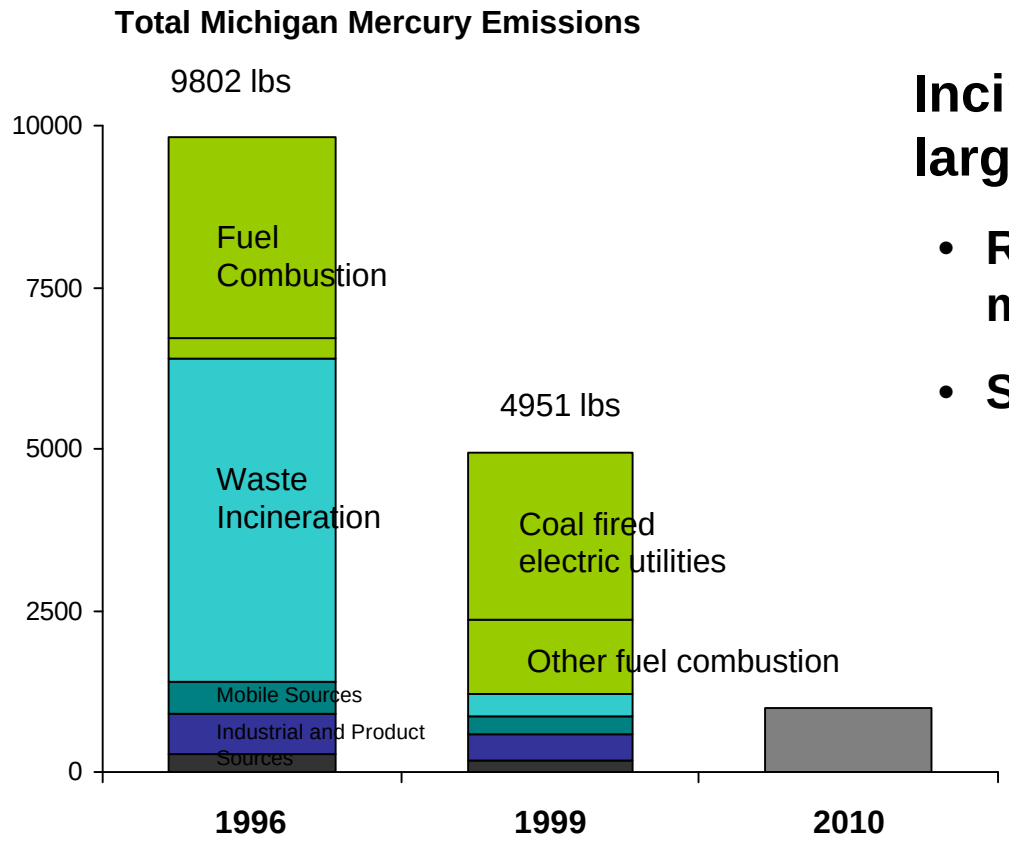
A look at 1996 and 1999 emissions in greater detail….

Michigan Hg Emissions

Sector	Major sub-sectors	1996	1999
Fuel Combustion		3400	3747
	Coal Combustion	3116	2731
	Oil combustion	208	439
	Natural Gas Combustion	0	568
Waste Incineration		4996	348
	Municipal Waste	1258	176
	Medical Waste	3405	10
	Sewage Sludge	286	162
Mobile Sources		502	268
Area Sources		283	197
	Lamp Manufacturing/ Breakage	88	69
	Bench Scale reagents (research)	121	65
	Dental Amalgam		53
Industrial/Point Sources		622	391
	Cement Manufacturing	123	67
	Electric Arc Furnaces	450	60
	Secondary Metal (Grey Iron)		258
TOTAL		**9802**	**4951**

Sources: 1996 data compiled by NWF from EPA, DEQ sources, 1999 data is DEQ's latest draft revision of 1999 updated with some 2000 data

Any plan for major further reductions must address coal fired electric utilities



Incinerators have the largest reductions to date:

- **Reduction of mercury in major consumer products**
- **Stiffer MACT standards**

- **Emissions from Coal- fired electric utility boilers now represent 55% of total State emissions**

Coal fired electric utilities

Current status:
- **55%** of total 1999 emissions
- **12%** reduction achieved from 1996

Current (1999) emissions	50% reduction on 1996 levels	70% reduction	90% reduction
2591 lbs Hg	1548	929	310

2010

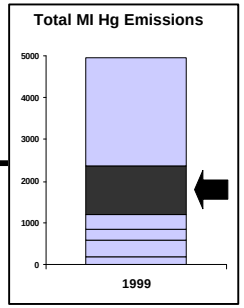
Methods and costs of achieving reduced emissions:

Improved emissions controls	$31.8M to $180.8M	$75.7M to $185.3M for 76% reduction	$156M to $192.3M for 88% reduction
This is equivalent to (for avg of hi/lo):	1.5 mills/kwh 2.2% increase on consumers bill	1.9 mills/kwh 2.7%	2.5 mills/kwh 3.7%
Hg reduction:	1110 lbs Hg	1851 lbs	2221 lbs

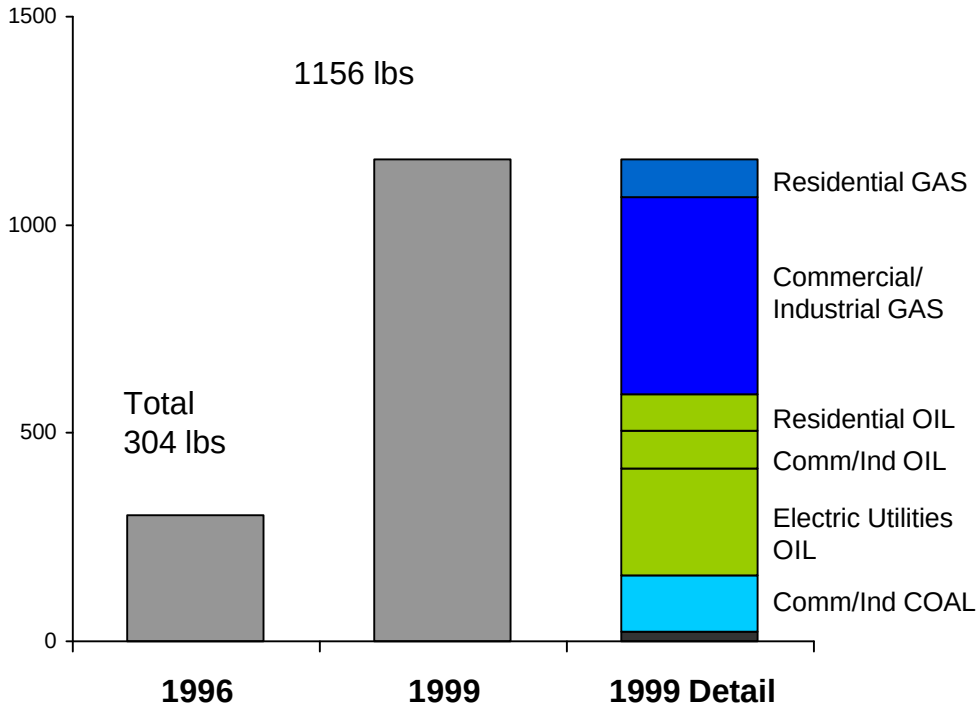
Fuel switching — 30% shift to natural gas possible by 2020 as old plants are retired? Cost of incentives?

Energy conservation — 15-30% reduction possible by 2020 with moderately aggressive public education and institutional buy-in — $1.5 M/ year

Commercial, industrial and residential boilers are also responsible for significant emissions – but some data remain uncertain



Fuel combustion other than coal fired electric utilities



- **Emissions from other forms of fuel combustion appear to have nearly tripled since 1996**
- Much of the increase is probably due to changes in emissions factors and more specific tracking, suggesting that **earlier emissions may have been understated.**
- **Natural gas emissions, however, may be overstated** as difficulties remain in validating new emissions factors used in this area. Questions remain about emissions factors used for natural gas boilers.

Nonetheless, these areas, together and singly, remain substantial emissions concerns

Smaller scale fuel combustion

Current status:
- **23%** of total 1999 emissions
- **376%** increase from 1996*

Current (1999) emissions	50% reduction on 1996 levels		70% reduction	90% reduction
1156 lbs Hg*	152*	2010	91	30

Methods and costs of achieving reduced emissions:

For oil utilities and large industrial boilers – Estimated total of 780 lbs emissions

Improved emissions controls	Are likely feasible and cost effective for larger commercial and industrial boilers	Possible 500+lb Hg elimination
Fuel switching	Shift to natural gas and possibly fuel cells will occur as old plants are retired. Possible incentives?	Possible 100+lb Hg elimination

For residential and small commercial boilers – Estimated total of 376 lbs emissions

Fuel switching	Shift to natural gas, renewable sources possible as furnaces are replaced? Cost of any incentives depends on relative fuel price.	Possible 30+ lbs Hg elimination

*Questions around validity of both 1996 and 1999 numbers make determining accurate emissions levels and cost estimates difficult

Mobile Sources

Current status:
- **5%** of total 1999 emissions
- **47%** reduction from 1996*

Current (1999) emissions	50% reduction on 1996 levels	70% reduction	90% reduction
268 lbs Hg	251	151	50

2010

Methods and costs of achieving reduced emissions:

All of these activities will be undertaken primarily to achieve other goals, no additive cost for mercury benefits

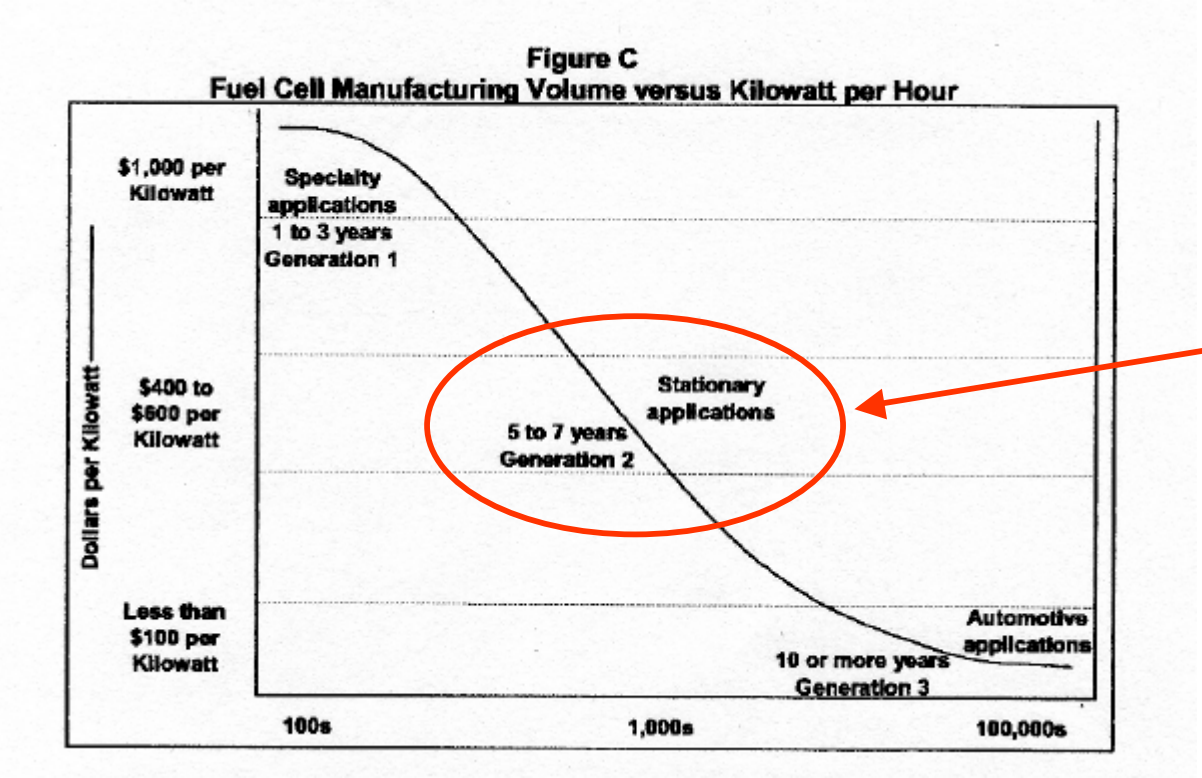
Efficiency improvements	NESCAUM report details positive impact of regulation on auto innovation, improvements in fuel efficiency	10% by 2010
Fuel switching	3% hybrids by 2009 – enhanced state incentives? Fuel cell project.	5% by 2010
Conservation	Public transportation – the commuter rail project	3% by 2010

Total: Possible 48lb Hg elimination without additive cost

Sector will not reach 90% by 2010, but is likely to achieve 90% or even virtual elimination by 2020 if ICE is phased out

New technologies may pose other toxics hazards, proper management should be built into design.

Fuel cells may have nearer term applications that could alleviate mercury emissions - State focus fortuitous



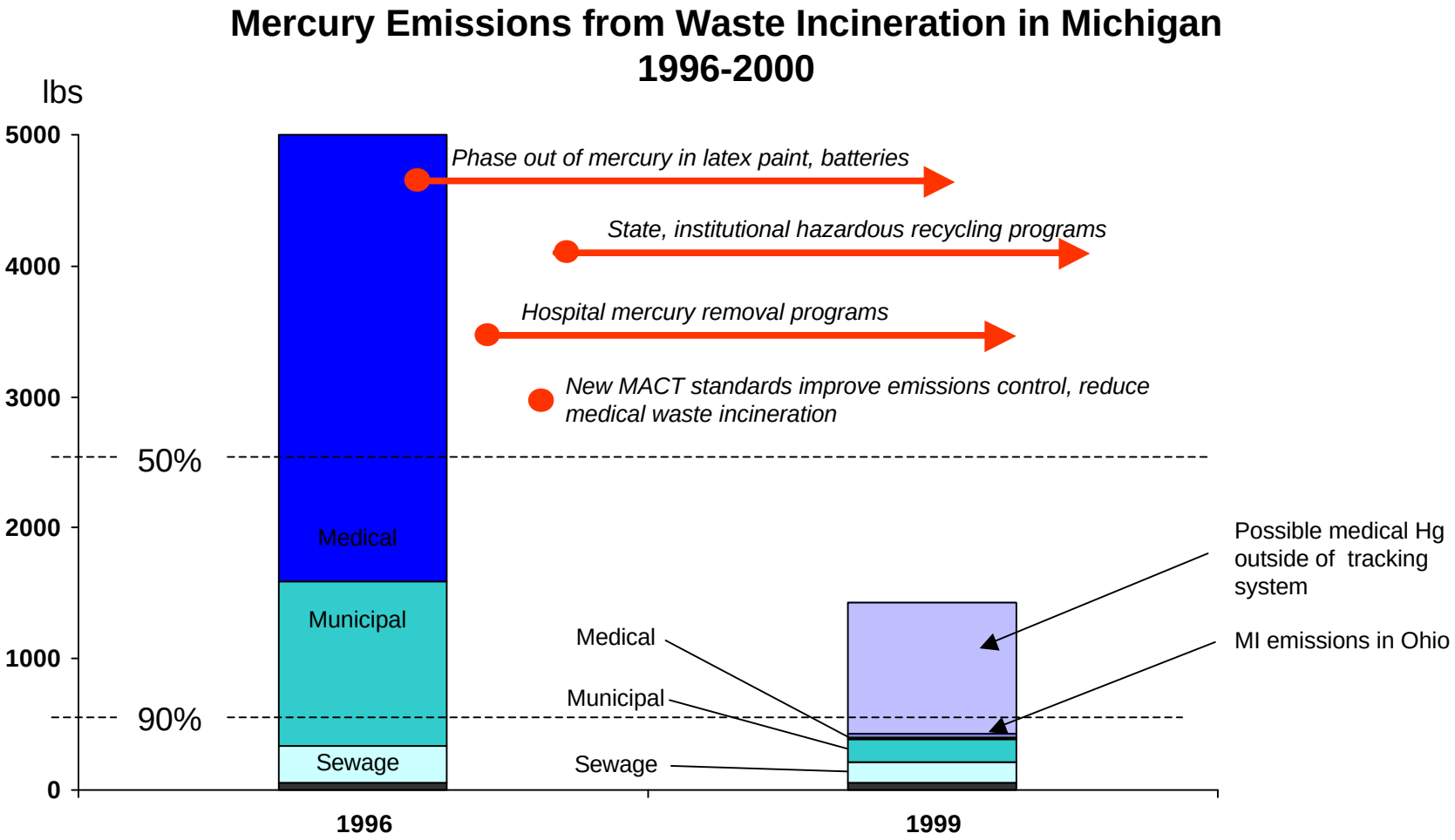
Within our time frame.

State could encourage.

Are applications appropriate?

Smith, Brett " Positioning the State of Michigan as a leading candidate for Fuel Cell and Alternative Powertrain Research" Center for Automotive Research, August 2001

Waste Incineration: Emissions reductions of at least 70% have been achieved by sector as a whole – further reductions still feasible



Medical Waste Incineration

Current status:
- **<1%** of total 1999 emissions*
- **68-98%** reduction from 1996*

Current (1999) emissions	50% reduction on 1996 levels	70% reduction	90% reduction	99% 'Virtual Elimination'
10-1045 lbs Hg*	1703 acheived	1022 acheived	341	34

2010

Methods and costs of achieving reduced emissions:

Replacement of Hg bearing products

	$1.86M
This is equivalent to:	$0.25 per bed per day for one year
Hg reduction:	704 lbs eliminated

Improved waste segregation and overall waste reduction

	$1.60M per year (16M total)
This is equivalent to:	$0.20 per bed per day
Hg reduction:	307 lbs

Improved emissions controls

Single facility in MI generates only 10 lbs of emissions and meets MACT standards – no further controls worthwhile

* Shift away from local incineration means some emissions take place out of state, and may leave substantial emissions untracked

Municipal Waste Incineration

Current status:
- **4%** of total 1999 emissions
- **86%** reduction from 1996

Current (1999) emissions	50% reduction on 1996 levels	70% reduction	90% reduction	99% 'Virtual Elimination'
176 lbs Hg	629 acheived	377 acheived	126	13

2010

Methods and costs of achieving reduced emissions:

Additional emissions controls at Detroit*

$404K/yr

This is equivalent to: <2% of annual operating cost

Hg reduction: 67 lbs

Further waste diversion and product replacement

(enhanced thermometer exchange and household hazardous waste programs)

$700K -$2.0M/yr

This is equivalent to: Less than 50 cents per household

Hg reduction: 18 lbs

Further product legislation Additional legislation prohibiting sale of additional Hg bearing products would further reduce Hg levels in municipal waste – limited additional cost to state.

* The Jackson incinerator also lack carbon injection, and appears to be releasing even higher levels of mercury per ton burnt. Its volume is so low however, that it is not a major source of emissions. Nonetheless, at an additional cost of approximately $160K another 10 lbs of Hg reduction could likely be acheived

Sewage Sludge Incineration

Current status:
- **3%** of total 1999 emissions
- **43%** reduction from 1996*

Current (1999) emissions	50% reduction on 1996 levels	70% reduction	90% reduction	99% 'Virtual Elimination'
162 lbs Hg*	143	86	29	3

Methods and costs of achieving reduced emissions:

2010

Improved emissions controls at Detroit Wastewater

$334 K

Hg reduction: 138 lbs eliminated

Removal of Hg from the waste stream
(dental amalgam, industrial sources)

Dental and medical facilities well-suited to better controls on mercury releases – costs for medical mercury removal are accounted for in the discussion of medical waste, above. Dental amalgam traps are also feasible and cost effective – phase out of mercury amalgam should also be considered.

* There is at least one other, and possibly several, smaller sewage sludge incinerators in MI not included in the DEQ inventory. Ypsilanti plans a new sludge incinerator that includes activated carbon emissions controls.

Industrial Sources: Electric Arc Furnaces, Secondary Metals, Cement Kilns

Current status:
- **8%** of total 1999 emissions
- **37%** reduction achieved from 1996

Current (1999) emissions	50% reduction on 1996 levels	70% reduction	90% reduction
391 lbs Hg	311	186	62

2010

Methods and costs of achieving reduced emissions:

Remove Hg bearing switches from vehicles prior to scrapping

(at end of life, resale, etc. using dedicated mercury removal only sites)

$4.7 M/yr for 84% reduction

This is equivalent to (for avg of hi/lo): $11/ vehicle or less than one fill up

Hg reduction: 286 lbs

Improve emissions controls

For the single MI cement kiln only – annual cost estimated as comparable to large incinerator. P2 is preferable for metal industries since major Hg input is identifiable and removable.

$210 K/yr

Hg reduction: 53 lbs

Eliminate Hg switches

For new vehicles - state bans on sales of new vehicles with Hg switches (as in Sweden and Maine) are preferable and will greatly reduce emissions from this sector without requiring further action or controls.

Area Sources: Dental Amalgam, Flourescent Lamps, Reagents

Current status:
- **4%** of total 1999 emissions
- **30%** reduction achieved from 1996

Current (1999) emissions	50% reduction on 1996 levels	70% reduction	90% reduction
197 lbs Hg	142	85	28

Methods and costs of achieving reduced emissions:

2010

Reduce and control use	The mercury in many products has been phased out - the remaining products either contain only trace amounts, or there is no substitute technology. In these cases reducing mercury use and ensuring proper handling and recycling is the appropriate approach. --Fluorescent lamps, for example, use far less mercury today than a decade ago, are increasingly being recycled. --Chemical reagents can in some cases be replaced in the context of comprehensive mercury reduction programs The costs for enhanced mercury management programs is captured in the medical and municipal waste sections of this report	Little added costs
Replace with Hg free substitue	Mercury free alternatives to dental amalgam do exist and should be increasingly employed Costs are less of an obstacle in this area than political and professional concerns – state could play a role in mediating dialogue on this issue.	Limited cost
	An overall reduction of 30% from 1999 levels should be feasible	59 lbs

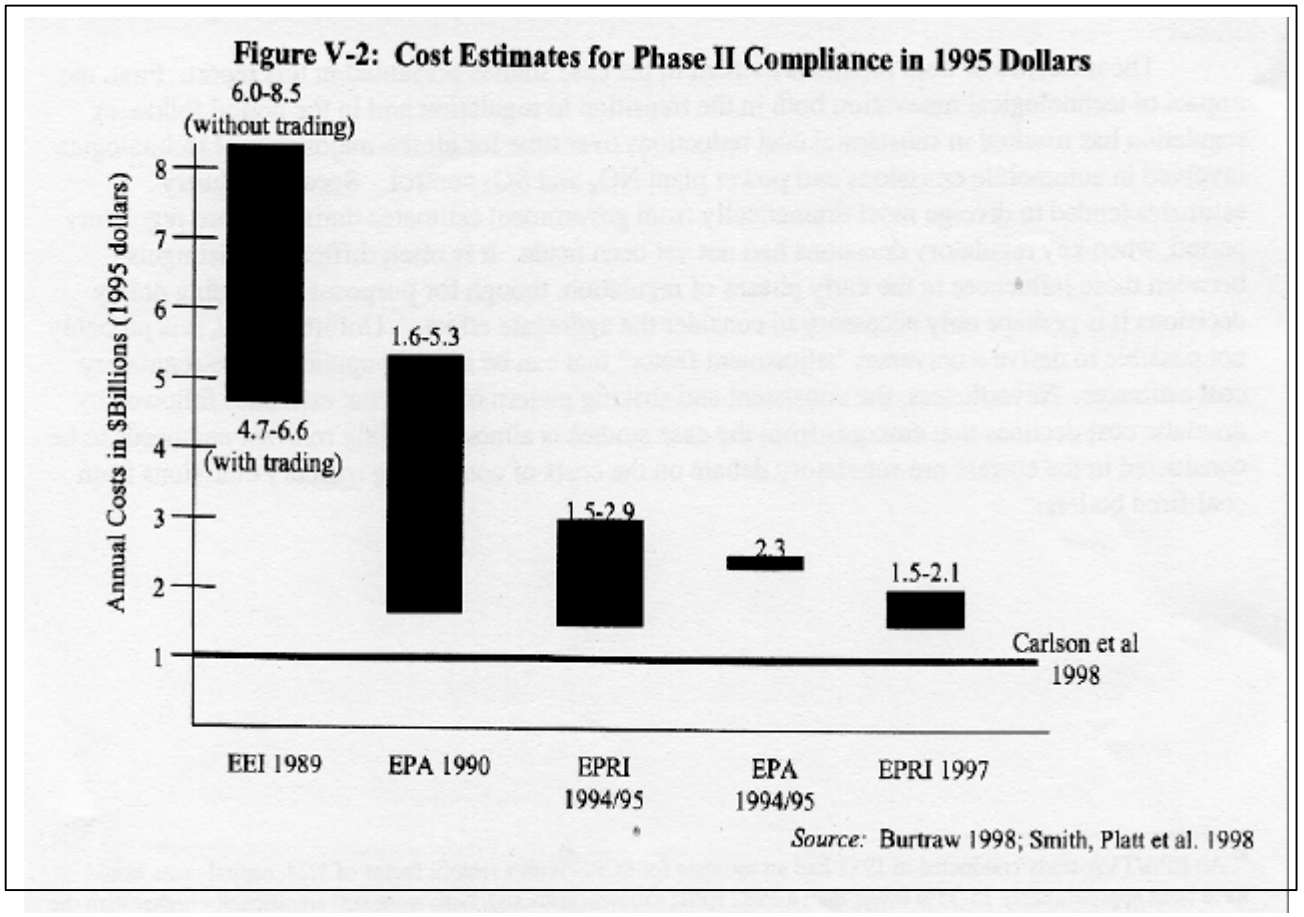
Summary

Sector/ Subsector	1999	% of total	*Maximum acheivable level by 2010* 50%	70%	90%	VE	Hg reduced or eliminated	Cost/yr
Coal fired electricity boilers	2591 lbs	55%			X		2221 lbs	$174.1 M
Other fuel combustion	1156 lbs	23% (hi)		X			600+ lbs	*Clarity around natural gas data critical to estimates in this area*
Mobile Sources	268 lbs	5%	X				48 lbs	$0
Waste Incineration							*Not included in 1999 inventory*	
Medical	10-1045 lbs	--- (lo)	— *achieved* —			X	1011 lbs	$17.9 M
Municipal	176 lbs	4%	——— *achieved* ———			X	85 lbs	$6.1 M
Sludge	162 lbs	3%			X		138 lbs	$0.3 M
Industrial Sources – Electric Arc Furn., etc.	391 lbs	8%			X		339 lbs	$4.9 M
Area Sources – Product man. & use	197 lbs	4%	X				59 lbs	--
TOTAL	4951 lbs	100%					3490 lbs	<$300M

Remaining MI Hg emissions → **1461+ lbs = 85+% reduction from 1999**

Especially in concert with regulation, control technology costs are likely to drop substantially from estimates

One of several NESCAUM diagrams showing change over time in cost estimates for compliance with – in this case SOx - emissions regulation



Status of Michigan Mercury Phaseout Program:

- Discussions with Michigan DEQ ongoing
- Discussions with U.S. EPA ongoing
- Study due to be distributed for peer review next month

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